

IS 10322 (Part 5/Sec 8) : 2013

(Superseding IS 9583 : 1981)

(Reaffirmed 2018)

भारतीय मानक

प्रदीपक

भाग 5 विवरणात्मक अपेक्षाएँ

अनुभाग 8 आपातकालीन प्रकाश-व्यवस्था

Indian Standard

LUMINAIRES

PART 5 PARTICULAR REQUIREMENTS

SECTION 8 EMERGENCY LIGHTING

ICS 29.140.40

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BUREAU OF INDIAN STANDARDS

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FOREWORD

This Indian Standard (Part 5/Sec 8) was adopted by the Bureau of Indian Standards, after the draft finalized by the Illumination Engineering and Luminaires Sectional Committee had been approved by the Electrotechnical Division Council.

This standard covers the requirements of luminaires for emergency lighting chains. This standard covers safety and performance requirements.

This standard (Part 5/Sec 8) is one among the series of Indian Standards which deals with luminaries. The others parts and sections are as follows:

Part 1	General requirements
Part 5	Particular requirements
(Part 5/Sec 1)	General purpose luminaires
(Part 5/Sec 2)	Recessed luminaires
(Part 5/Sec 3)	Luminaires for road and street lighting
(Part 5/Sec 4)	Portable general purpose luminaires
(Part 5/Sec 5)	Flood lights
(Part 5/Sec 6)	Handlamps
(Part 5/Sec7)	Lighting chains

This standard is to be read in conjunction with IS 10322 (Part 1) : 2010 'Luminaires : Part 1 General requirements'. For the sake of convenience, the clauses of this standard correspond to those of IS 10322 (Part 1), instead of reproducing full text of each clause; reference to relevant clauses of IS 10322 (Part 1) has been given.

This standard is based on IEC 60598-2-22, (1997) + Amendment 1 (2002), 'Luminaires — Part 2 : Particular requirements, Section 22 Luminaires for emergency lighting', issued by the International Electrotechnical Commission (IEC).

After the publication of this standard, IS 9583 : 1981 shall be treated as withdrawn since the requirements given in IS 9583 has been covered in this standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard***LUMINAIRES****PART 5 PARTICULAR REQUIREMENTS****SECTION 8 EMERGENCY LIGHTING****1 SCOPE**

This standard (Part 5/Sec 8) specifies requirements for emergency lighting luminaires for use with electrical light sources on emergency power supplies not exceeding 1 000 V.

This standard does not cover the effects of non-emergency voltage reductions on luminaires incorporating high pressure discharge lamps.

This standard also includes relevant requirements and tests that shall be conducted and complied with for control gears, as specified in relevant Indian Standard, that incorporate additional facilities such as remote control devices, indicators, changeover devices, etc.

2 REFERENCES

The following standards are necessary adjunct to this standard:

<i>IS No.</i>	<i>Title</i>
1416 : 1972	Safety transformer (<i>first revision</i>)
2215 : 2006	Starter for fluorescent lamps (<i>first revision</i>)
9457 : 2005	Safety colours and safety signs
10322 (Part 1) : 2011	Luminaires: Part 1 General requirements and tests
14218 : 1994	Sealed cylindrical type rechargeable nickel cadmium cells
15549 : 2005	Stationary valve regulated lead acid batteries
15885 (Part 1) : 2011	Safety of lamp controlgear: General requirements
(Part 2/Sec 3) : 2011	Particular requirements, Section 3 ac supplied electronic ballasts for fluorescent lamps
SP 30 : 2011	National Electric Code
IS/IEC 60079	Electrical apparatus for explosive gas atmospheres

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 10322 (Part 1/Sec 1) and the following shall apply.

3.1 Emergency Lighting — Lighting for use when the supply to the normal lighting fails; it includes emergency escape lighting, high-risk task-area lighting and standby lighting.

3.2 Emergency Escape Lighting — That part of emergency lighting that provides illumination for the safety of people leaving an area or attempting to terminate a dangerous process before vacating an area.

3.3 Standby Lighting — That part of emergency lighting that enables normal activities to continue substantially unchanged.

3.4 High-risk Task-area Lighting — That part of emergency lighting provided to ensure the safety of people involved in a potentially dangerous process or situation and to enable proper shut down procedures for the safety of the operator and occupants of the premises.

3.5 Maintained Emergency Luminaire — Luminaire in which the emergency lighting lamps are energized at all times when normal or emergency lighting is required.

3.6 Non-maintained Emergency Luminaire — Luminaire in which the emergency lighting lamps are in operation only when the supply to the normal lighting fails.

3.7 Combined Emergency Luminaire — Luminaire containing two or more lamps, at least one of which is energized from the emergency lighting supply and the others from the normal lighting supply. A combined emergency luminaire is either maintained or non-maintained.

3.8 Self-contained Emergency Luminaire — Luminaire providing maintained or non-maintained emergency lighting in which all the elements, such as the battery, the lamp, the control unit and the test and monitoring facilities, where provided, are contained within the luminaire or adjacent to it (that is, within 1 m cable length).

3.9 Centrally Supplied Emergency Luminaire — Luminaire for maintained or non-maintained operation which is energized from a central emergency power system that is not contained within the luminaire.

3.10 Compound Self-contained Emergency Luminaire — Self contained luminaire providing maintained or non-maintained emergency lighting and also providing emergency supply for operating a satellite luminaire.

3.11 Satellite Emergency Luminaire — Luminaire for maintained or non-maintained operation which derives emergency operation supply from an associated compound self-contained emergency luminaire.

3.12 Control Unit — Unit or units comprising a supply changeover system, a battery charging device and, where appropriate, a means for testing.

NOTE — For tubular fluorescent lamp luminaires, this unit may also contain the lamp controlgear.

3.13 Normal Supply Failure — Condition in which the normal lighting can no longer provide a minimum illuminance for emergency escape purposes and when the emergency lighting should become operative.

3.14 Emergency Luminaire Rated Lumen Output — Lumen output as claimed by the luminaire manufacturer 60 s (0.25 s for high-risk task-area lighting luminaires) after failure of the normal supply, and continuously to the end of rated duration of operation.

3.15 Rated Duration of Emergency Operation — Time, as claimed by the manufacturer, that the rated emergency lumen output is provided.

3.16 Normal Mode — State of a self-contained emergency luminaire that is ready to operate in emergency mode while the normal supply is on. In the case of a normal supply failure, the self-contained luminaire automatically changes over to the emergency mode.

3.17 Emergency Mode — State of a self-contained emergency luminaire that provides lighting when energized by its internal power source, the normal supply having failed.

3.18 Rest Mode — State of a self-contained emergency luminaire that has been intentionally extinguished while the normal supply is off and that, in the event of restoration of the normal supply, automatically reverts to normal mode.

3.19 Maximum Overcharge Rate — Maximum continuous charge rate that may be applied to a fully charged battery.

3.20 Remote Inhibiting Facility — Means for inhibiting remotely a luminaire associated with an emergency lighting system.

3.21 Remote Inhibiting Mode — State of a self-contained emergency luminaire which is inhibited from operating by a remote device while the normal supply is on and in case of a normal supply failure the luminaire does not change over to emergency mode.

4 GENERAL TEST REQUIREMENTS

The provisions of IS 10322 (Part 1/Sec 0) shall apply. The tests described in each appropriate section of

IS 10322 (Part 1) shall be carried out in the order listed in this standard.

When testing combined emergency luminaires according to the requirements of this section, the tests shall be limited to those parts of the luminaire which are involved with providing emergency lighting. The components and parts of the luminaires designed to provide only normal lighting shall be subjected to the tests according to the requirements of the relevant section of IS 10322 (Part 5) (for example, if the luminaire is recessed, it shall be tested according to the requirements of the section dealing with recessed luminaires).

If some elements of an emergency luminaire are adjacent (within 1 m cable length) to the main part of the luminaire all the elements of the luminaire, including the means of inter-connection, shall satisfy the relevant requirements of this section.

5 CLASSIFICATION OF LUMINAIRES

Emergency lighting luminaires shall be classified in accordance with the provisions of IS 10322 (Part 1/Sec 2) except that all emergency lighting shall be classified as suitable for direct mounting on normally flammable surfaces (F-marked).

Emergency lighting luminaires shall also be classified as specified in Annex A.

6 MARKING

The provisions of IS 10322 (Part 1/Sec 3) shall apply together with the requirements of 6.1 to 6.19.

6.1 Luminaires shall be clearly marked with the rated supply voltage or voltage range(s).

6.2 Luminaires shall be clearly marked with details of their classification according to 5 of IS 10322 (Part 5/Sec 8) (*see* Annex A).

6.3 Luminaires shall be clearly marked with details of the correct replacement lamp in a position visible during lamp replacement. This ensures that the rated emergency lumen output can be achieved.

NOTE — The information relating to correct lamp replacement may include the number, type, rated voltage and rated wattage, etc.

6.4 Where appropriate, in addition to t_a marking, the range of ambient temperature shall be marked or given in the instruction leaflet supplied with the luminaire.

6.5 Emergency luminaires employing replaceable fuses and/or replaceable indicator lamps shall be marked with the details of fuse ratings and/or details of the indicator lamps.

6.6 Test facilities to simulate normal supply failure, where provided, shall be clearly marked so that the marking is visible during routine testing.

6.7 Self-contained luminaires shall be clearly marked with the details of correct battery replacement including the battery type and rated voltage.

6.8 In self-contained luminaires, the batteries shall be marked with the year and month or year and week of manufacture and the correct battery disposal method to be followed.

Space shall be provided on the battery label to permit the marking, by the installer or commissioning engineer, of the date of commissioning of the battery.

6.9 Combined emergency luminaires shall be marked with details relating to correct lamp replacement for all lamps. If the lamps used in the emergency circuit and the normal supply circuit differs, the type shall be clearly identified.

Lampholders for emergency lighting lamps in combined luminaires shall be identified by a green dot, at least 5 mm in diameter, which shall be visible when replacing the lamp.

6.10 In the instruction leaflet supplied with the self-contained emergency luminaire, the manufacturer shall state that the replacement of batteries is needed when the self-contained luminaire no longer meets its rated duration of operation.

6.11 In the instruction leaflet supplied with the luminaire the manufacturer shall give details of test facilities incorporated in the luminaire or appropriate instructions, if these test facilities are supplied separately. The instructions shall include details of test procedures.

6.12 In the instruction leaflet supplied with the luminaire, the manufacturer shall give details of the connection leads to be used between a compound self-contained luminaire and an associated satellite luminaire. The maximum length of cables that limits the voltage drop to 3 percent shall be specified.

6.13 In the instruction leaflet supplied with the luminaire, the manufacturer shall give details of the rated emergency lumen output in the emergency mode.

6.14 In the instruction leaflet supplied with self-contained emergency luminaires, the manufacturer shall give details of any device which changes the mode of operation.

6.15 The manufacturer shall make available the photometric data in accordance with 17.

6.16 Any normal preparation procedure for use of the luminaire shall be stated in the manufacturer's

installation instructions. This preparation shall be carried out before type tests are made.

6.17 The marking required by 6.1 and 6.2 shall be in a position such that the information can be seen when the luminaire has been installed.

NOTE — For recessed luminaires, this information may be marked on the interior of the luminaire so that it is visible when the light controlling cover is removed.

6.18 The mounting instructions for luminaires intended for external plug and socket connections, without provisions to prevent accidental disconnection, shall be provided with the following warning:

This luminaire is intended only for mounting in locations where the plug and socket are protected from unauthorized disconnection.

6.19 Compliance with the requirements of 6.1 to 6.18 is checked by inspection.

7 CONSTRUCTION

The provisions of IS 10322 (Part 1/Sec 4) shall apply together with the requirements of 7.1 to 7.19.

7.1 In emergency luminaires, fluorescent lamps used to provide emergency lighting shall start in the emergency mode without the aid of glow starters as specified in IS 2215. Such starters shall not be in circuit during the emergency mode. The emergency lighting shall not be provided by means of fluorescent lamps with built-in glow starters.

Compliance is checked by inspection.

7.2 Lamp control gear for operating the emergency lamp(s) and control units incorporated into emergency luminaires shall comply with IS 15885 (Part 1).

Compliance is checked by the tests specified in the relevant sections of this standard.

7.3 The failure of any one luminaire connected to a circuit shall not affect other luminaires connected to the same circuit.

NOTE — This requirement can be satisfied by means of a fuse, relay or other protective devices incorporated in each luminaire, or by protection against excessive fault currents being inherent in the design of the luminaire circuitry/components.

Compliance is checked by measurement and inspection.

7.4 For emergency luminaires, the mechanical strength tests given in 4.13 of IS 10322 (Part 1) shall be applied with minimum impact energy of 0.35 Nm to all external parts.

7.5 Whilst connected to a live supply, self-contained emergency luminaires shall have adequate separation between the normal supply and live parts in the circuit

for battery charging. When there are exposed live parts, double insulation, reinforced insulation, earth screen or other equivalent techniques can be used.

Additionally, in the event of bare contacts in the battery charging circuit a safety isolating transformer shall be used. If a separating transformer is used as insulation between the normal supply and the battery charging circuit, the insulation in the battery charging circuit shall consist of at least basic insulation.

Compliance is checked by inspection and by the tests of **8** and **15**.

7.6 In centrally supplied combined emergency luminaires, electrical separation between normal and emergency supplies shall be ensured by double insulation, reinforced insulation, earthed screen or other equivalent means.

NOTE — The use of basic insulation only, for both circuits, and double/reinforced insulation on the normal supply circuit fulfils this requirement. The connection of both circuits to a terminal block where the required creepage/clearances are obtained by leaving one terminal free, without the possibility of connection between the circuits, is also acceptable.

Compliance is checked by inspection.

7.7 Self-contained emergency luminaires shall have adjacent to them or incorporated in them a device for charging the battery from the normal supply and an indicator visible in normal use, for example a lamp, which shows the following conditions:

- a) Battery is being charged; and
- b) Circuit continuity exists through the tungsten filament of emergency lighting lamps where appropriate.

When a single indicator provides dual functions, either red or green is acceptable.

Compliance is checked by inspection.

7.8 Self-contained emergency luminaires shall incorporate a battery that meets the requirements of Annex B and is designed for at least four years of normal operation. This battery shall be used only for emergency related functions within the luminaire or its satellite.

Compliance is checked by inspection and the tests of Annex B.

7.9 Internal wiring and electronic circuits in self-contained emergency luminaires shall be protected from excessive discharge currents that may occur during fault conditions by incorporation of a safety device between the batteries and the electronic circuits.

Compliance is checked by inspection.

NOTE — A test to check compliance with this requirement is under consideration.

7.10 In self-contained emergency luminaires there shall be no switch between the battery and emergency lighting lamps other than the changeover device.

Self-contained emergency luminaires and centrally supplied emergency luminaires shall not contain any manual or non-self-resetting switch isolating the emergency circuit(s) from the mains supply other than rest mode or inhibition mode testing facilities.

Compliance is checked by inspection.

7.11 In self-contained emergency luminaires the failure of one or more emergency lighting lamps shall not interrupt the charging current to the battery and shall not cause an overload that could impair the operation of the battery.

Compliance is checked by simulation of lamp failure during the test of **13.7**.

7.12 All self-contained emergency luminaires utilizing lead-acid batteries, and self-contained emergency luminaires utilizing a battery of three or more nickel cadmium cells in series, shall be protected against polarity reversal of individual cells. This protection shall be achieved by the incorporation of an electrical system that limits further battery discharge to the current specified in **7.12** (a) when the battery voltage has fallen to V_{\min} , determined in **7.12** (b).

- a) For lead-acid batteries: $10^{-5} \times C_{20}A$ where C_{20} is the battery capacity in ampere hours for a 20 h constant current discharge.
For nickel-cadmium batteries: $0.0015 \times C_5A$ where C_5 is the battery capacity in ampere hour for 5 h constant current discharge.
- b) $V_{\min} = X.n$
where n is the number of cells,
 - 1) for lead acid batteries:
 $X = 1.6 \text{ V}$ for 1 h duration or less;
 $X = 1.7 \text{ V}$ for greater than 1 h duration;
and
 - 2) for nickel-cadmium batteries:
 $X = 0.8 \text{ V}$ for all duration values.

The protection system shall prevent any further discharge of the batteries by a lamp or inverter, even where a battery voltage rise due to natural regeneration occurs, until the normal supply has been restored.

Compliance is checked by measuring the battery voltage and discharge current during the emergency mode cycle of the test given in **13.7**. The battery voltage

shall not fall below V_{\min} and the discharge current shall not exceed that specified above.

7.13 The operation of a self-contained emergency luminaire in the emergency mode shall not be influenced by a short-circuit, a contact to earth or an interruption, in the wiring of the normal supply.

Compliance is checked by simulation of these supply wiring faults during the emergency mode cycle of the test given in **13.7**. The luminaire shall function normally during the test.

7.14 Self-contained emergency luminaires with rest mode facility shall be provided with either a control device or a means of connection of a remote facility for changing from emergency mode to rest mode and *vice-versa*.

Self-contained emergency luminaires intended for use with remote inhibiting facilities shall be provided with a means of connection to the remote inhibiting circuit.

Compliance is checked by inspection.

7.15 The operation of a self-contained emergency luminaire with a remote inhibiting facility in the emergency mode shall not be influenced by a short circuit or a contact to earth in the wiring to a remote control device.

Compliance is checked by simulation of these wiring faults in conjunction with the test of **7.13**.

7.16 The operation of a remote control device for luminaires with rest mode or remote inhibiting facilities provided with the luminaire shall be independent of the battery of the luminaire and the normal mains supply.

Compliance is checked by inspection.

7.17 The operation of a self-contained emergency luminaire with rest mode facility in the emergency mode shall not be influenced by a short-circuit, a contact to earth or an interruption in the wiring to a remote control changeover device.

Compliance is checked by simulating these wiring faults in conjunction with the tests given in **7.13**.

7.18 In self-contained emergency luminaires with a rest mode or inhibiting facility, the current drain from the batteries with the luminaire in the rest mode shall not exceed the following:

- a) For lead-acid batteries $4 \times 10^{-5} \times C_{20}A$ where C_{20} is the battery capacity in ampere hours for a 20 h constant current discharge;
- b) For nickel-cadmium batteries $0,0015 \times C_5A$ where C_5 is the battery capacity in ampere hours for a 5 h constant current discharge.

Compliance is checked by measurement of the battery discharge current with the self-contained luminaire in the rest mode during the tests given in **13.7**.

7.19 In self-contained emergency luminaires providing emergency lighting by means of tungsten filament lamps, the lamp voltage, after 30 percent of rated duration of operation has elapsed in the emergency mode, shall not exceed 1.05 times rated lamp voltage.

Compliance is checked by measuring lamp voltage during the first 10 cycles of the endurance tests given in **13.1**.

8 CREEPAGE DISTANCES AND CLEARANCES

The provisions of IS 10322 (Part 1/Sec 11) shall apply.

9 PROVISION OF EARTHING

The provisions of IS 10322 (Part 1/Sec 7) shall apply.

10 TERMINALS

The provisions of IS 10322 (Part 1/Sec 14 and 15) shall apply.

11 EXTERNAL AND INTERNAL WIRING

Electrical connections to the mains, between separate parts of the luminaire (for example, remote control gear box) and between luminaire components shall be protected against the risk of accidental disconnection. Electrical connections shall be permanent or have a provision to prevent accidental disconnection. Internal plug and socket connections not having a provision against accidental disconnection are accepted, if direct access to them is prevented (for example, protected by a cover that cannot be removed by a single action with one hand). External plug and socket connections not having a provision against accidental disconnection are accepted, if the luminaire is provided with a warning as required by **6.18**.

Compliance is checked by inspection.

12 PROTECTION AGAINST ELECTRIC SHOCK

The provisions of IS 10322 (Part 1/Sec 8) shall apply.

13 ENDURANCE TEST AND THERMAL TEST

The provisions of IS 10322 (Part 1/Sec 12) shall apply together with the requirements of **13.1** to **13.7**.

Luminaires with an IP classification greater than IP20 shall be subjected to the relevant tests given in **12.4**, **12.5** and **12.6** of IS 10322 (Part 1/Sec 12) after the test(s) given in **9.2** but before the test(s) given in **9.3** of IS 10322 (Part 1/Sec 9) specified in **14**.

13.1 For self-contained emergency luminaires the endurance test shall be as specified in **12.3.1** of

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IS 10322 (Part 1/Sec 12) except that the requirements of items (c) and (d) shall be replaced by the following:

- c) The luminaire shall be tested in the enclosure for a total duration of 390 h, made up of 10 successive cycles of 36 h and a final normal operation for 30 h, at maximum rated supply voltage. The luminaire shall be operated normally from maximum supply voltage for 30 h and for 6 h in the emergency mode, in each of the 10 cycles.
- d) Compliance is checked by the requirements of **12.3.2** of IS 10322 (Part 1/Sec 12).

Additionally the luminaire shall operate satisfactorily during 50 supply voltage switching operations after the endurance test. Each switching operation shall consist of connection to the normal rated supply for 60 s and disconnection from the supply for 20 s.

Compliance is checked by inspection.

NOTES

1 For luminaires with short-rated durations or with an inbuilt delay after restoration of the normal supply and before the emergency lamp extinguishes, the duration of the 50 switching operations test should be modified as follows to ensure that the batteries are not fully discharged before the completion of the test:

- a) mains off = 20 s;
- b) mains on = delay + { (20 + delay) x Idmax } ÷ (0.65 × I_c);
- c) delay = time of delay (s);
- d) Idmax = maximum discharge current (A), according to **A-4.2d**;
- e) I_c = charge current (A).

For luminaires with an inbuilt delay, the emergency lamp may be switched off after 20 s using the appropriate device, for example rest mode facility, switch, push-button, etc.

2 The 11th (30 h) charge at the end of the endurance test is so that the 50 switching operations test can be started with the batteries fully charged. The luminaire could not otherwise be expected to perform satisfactorily with discharged batteries.

13.2 The thermal tests given in **12.4** and **12.5** of IS 10322 (Part 1/Sec 12) shall be carried out in both the normal operating mode and the emergency lighting mode. Luminaires designed to have pictograms applied to translucent parts shall be tested with those pictograms applied that give the most unfavourable thermal effect.

13.3 The conditions of test for luminaires in the emergency mode shall be as follows:

- a) for self-contained emergency luminaires: the temperature limits of IS 10322 (Part 1/Sec 12) shall apply at any time between switch-on of the emergency mode and complete battery discharge;

- b) for combined emergency luminaires: the two circuits shall be tested together unless it is evident from the construction that the two circuits are not designed for operation together.

13.4 For the purpose of **13.3**, complete battery discharge shall be indicated as given in Table 1.

NOTE — The values given apply at an ambient temperature of 20 ± 5°C.

13.5 The temperature allowance of 5°C specified in the first sentence of **12.4.2(a)** of IS 10322 (Part 1/Sec 12) shall be reduced to 2°C for the limiting temperature of batteries.

13.6 Self-contained emergency luminaires shall be subjected to an additional thermal test according to **12.5** of IS 10322 (Part 1/Sec 12) except that the abnormal service condition shall be the replacement of the internal batteries with a short-circuit link across the battery charger output. The luminaire shall comply with **12.5.2** of IS 10322 (Part 1), shall not become unsafe, and after removal of the short-circuit link, reconnection of the batteries and replacement of fuse-links where necessary, shall function normally.

13.7 On completion of the thermal test that is, having complete battery discharge according to **13.4**, a self-contained emergency luminaire shall be allowed to cool to its rated ambient temperature (*t_a*) or to 25°C whichever is the higher and shall be subjected to a 24 h charging cycle at 0.9 times rated supply voltage after which the luminaire, with the lamp as tested, shall provide the rated lumen output at the end of the rated duration of operation.

14 RESISTANCE TO DUST AND MOISTURE

The provisions of IS 10322 (Part 1/Sec 9) shall apply. For luminaires with IP classification greater than IP20, the order of tests specified IS 10322 (Part 1/Sec 9) shall be as specified in **13**.

15 INSULATION RESISTANCE AND ELECTRIC STRENGTH

The provisions of IS 10322 (Part 1/Sec 10) shall apply.

16 RESISTANCE TO HEAT, FIRE AND TRACKING

The provisions of IS 10322 (Part 1/Sec 13) shall apply together with the following requirements.

The enclosure of an emergency lighting luminaire shall withstand the test given in **13.3.2** of IS 10322 (Part 1) but at a test temperature of 850°C.

17 FUNCTIONAL SAFETY

17.1 All emergency luminaires shall provide the rated lumen output claimed by the manufacturer during the emergency mode. In addition, the following requirements shall be met.

Emergency luminaires shall provide 50 percent of the rated lumen output claimed by the manufacturer during operation in emergency mode 5 s after failure of the normal supply, and full rated lumen output after 60 s and continuously to the end of rated duration of emergency operation.

Emergency luminaires used for high-risk task-area lighting shall provide the necessary lamp current in order to achieve the rated lumen output claimed by the manufacturer during operation in emergency mode within a maximum 0.25 s after failure of the normal supply, and continuously to the end of rated duration of emergency operation.

Compliance is checked by measurement and by the following tests:

- For self-contained luminaires in emergency mode during operation from the internal batteries after a 24 h charge at 0.9 times the minimum rated voltage.
- For centrally supplied luminaires during operation at 0.85 times the minimum rated supply voltage when stable thermal conditions have been reached.

Measurements for both self-contained emergency luminaires and centrally supplied emergency luminaires shall be made using a new lamp.

NOTE — When measuring the lumen output of centrally supplied luminaires, the minimum rated supply voltage should be reduced to include an allowance for cable volt drop.

17.2 The manufacturer shall make available the photometric distribution data for the luminaire in emergency mode of operation.

This data shall be corrected for the conditions of minimum luminous flux resulting from the combined effects of,

- the minimum discharge voltages as specified in Table 1 or switch-off voltage specified by the manufacturer; and
- the minimum operating voltage, including cable voltage drop for centrally supplied luminaires, 60 s (0.25 s for high-risk task-area lighting luminaires) after interruption of the normal supply and subsequently during continuous operation to the end of the stated duration of the emergency lighting system.

Table 1 Voltage Limits for Discharge Durations up to the End of Declared Battery Life
(Clauses 13.4 and 17.2)

Sl No.	Battery Type	Discharge Conditions	
		Up to 1 h Duration V/cell	Greater than 1 h Duration V/cell
(1)	(2)	(3)	(4)
i)	Nickel cadmium	1.0	1.0
ii)	Lead acid	1.75	1.80

17.3 Photometric measurements on the luminaire shall be made in accordance with the requirements of the relevant Indian standards, if any.

NOTE — Indian Standard on photometric measurements of luminaires for emergency lighting is under consideration.

Compliance is checked by measurement of the following:

- Light output ratio; and
- Intensity distribution table of the luminaire, constructed in 5° steps of gamma in the C-planes C_0 and C_{90} , where every value measured shall be at least 95 percent of the value claimed by the manufacturer.

NOTE — During the measurement of the photometric properties it might be necessary to feed the luminaire by a power supply providing the same voltage/current as the battery at the end of rated duration.

17.4 In order to identify safety colours, the minimum value for the colour-rendering index of the light source in an emergency escape lighting luminaire shall be $R_a > 40$.

Compliance is checked by inspection.

17.5 Internally illuminated emergency safety signs shall meet the following illuminance and luminance requirements in the emergency mode:

- Colour** — It shall conform to the requirements of IS 9457;
- Luminance** — The luminance of any area of safety colour of the sign shall be at least 2 cd/m² in all relevant viewing directions.

NOTE — The following values are currently under consideration:

- Luminance ratio, L_{\max}/L_{\min} within either white or the safety colour;
- Luminance ratio $L_{\text{white}}/L_{\text{colour}}$; and
- Disability glare.

Compliance is checked by measurement in accordance with Annex C.

18 CHANGEOVER OPERATION

18.1 Changeover from normal to emergency mode shall

occur at not less than 0.6 times rated supply voltage. It shall not occur at greater than 0.85 times rated supply voltage.

Compliance is checked by the tests described in **18.2**.

18.2 Following complete battery discharge according to **13.4**, the luminaire shall be subjected to a 24 h charging cycle at 0.9 times the rated supply voltage in its normal lighting mode, if applicable.

The supply to the luminaire shall then be reduced within 0.5 s to 0.6 times rated voltage after which the emergency lamps shall operate and remain operating to provide the declared rated luminaire emergency lumen output after 60 s, or lamp current after 0.25 s for high-risk task area lighting luminaires.

The luminaire supply shall be switched Off and On 500 times, each cycle consisting of 2 s Off and 2 s On (at 0.85 times supply rated voltage). After these cycles the supply shall again be reduced to 0.6 times rated voltage and the luminaire shall provide rated lumen output after 60 s or respective lamp current after 0.25 s for high-risk task area lighting luminaires.

The luminaire shall operate satisfactorily during and after the test.

NOTE — For luminaires with short-rated durations of operation or with an inbuilt delay after restoration of the normal supply before the lamp extinguishes, the 500 switching operations test may have to be adapted to ensure that the batteries are not fully discharged before the completion of the test. This can be achieved by the incorporation of additional charging periods between the switching operations (*see 13.1, Note 1*).

18.3 In self-contained emergency luminaires with rest mode facility, changeover from rest mode to normal mode shall occur automatically at not greater than 0.9 times rated supply voltage.

Compliance is checked by the test described in **18.2** but with the self-contained emergency luminaire put into the rest mode halfway through the 2 s supply off periods in the 500 switching cycles.

After the final lumen output measurement in accordance with **18.2**, the self-contained emergency luminaire shall be put in the rest mode and the supply slowly increased to 0.9 times rated voltage. The changeover from rest mode to normal mode shall operate automatically.

19 HIGH TEMPERATURE OPERATION

Emergency luminaires shall be capable of operating satisfactorily in the emergency mode at an ambient temperature of 70°C for at least half of the rated duration.

Compliance is checked by satisfying the following test.

The relative light outputs of the luminaire operating in the emergency mode at t_a and at an ambient temperature of 70°C shall be compared.

The battery shall be charged for 24 h at rated supply voltage. The emergency luminaire shall then be placed in a test chamber incorporating a remote light meter with fixed geometry in relation to the luminaire. With the ambient inside the chamber at t_a the luminaire shall be disconnected from the supply and the relative light output measured 60 s after interruption of the supply.

The luminaire shall be removed from the chamber and the battery charged for 24 h at rated supply voltage. The test chamber shall be pre-heated to give an internal ambient temperature of 70°C. The emergency luminaire shall be returned to the same position as for the previous test. After 1 h the luminaire shall be operated from the emergency supply. The light output reading shall not fall below 50 percent of the initial 60 s result at any time from 60 s to half the rated duration.

For central battery systems the voltage is considered constant and the battery may be substituted with a power supply.

NOTE — The light meter should have the photometer head outside of the enclosure so that it is not affected by the ambient temperatures. This can be achieved by the use of a clear glass window, fibre optic light guides, etc.

20 BATTERY CHARGERS FOR SELF-CONTAINED EMERGENCY LUMINAIRES

20.1 The battery charger shall provide the rated charge performance specified by the battery manufacturer (*see Annex B*) to charge batteries within 24 h over the rated ambient temperature range and when operating at voltages within the range of 0.9 times the rated supply voltage and 1.06 times the rated supply voltage.

Compliance is checked by test and measurement.

20.2 Transformers built into self-contained emergency luminaires for charging the batteries shall comply with the relevant requirement specified in IS 1416.

21 TEST DEVICES FOR EMERGENCY OPERATION

21.1 Self-contained emergency luminaires shall be provided with an integral test facility, or with the means of connection to a remote test facility, for simulating failure of the normal supply. Manual operated test switches shall be self-resetting or key operated.

The device shall be tested for compliance according to

the manufacturer's operating instructions.

21.2 Any remote test device used in conjunction with emergency lighting luminaires shall not influence the normal operation of the luminaire, other than for testing.

22 REST MODE AND INHIBITION MODE FACILITIES

Self-contained emergency luminaires shall be provided with facility for rest mode and inhibition mode facilities as given in Annex D.

ANNEX A

LUMINAIRE CLASSIFICATION

(Clauses 5 and 6.2)

A-1 Emergency lighting luminaires shall be classified and marked as to their construction as follows.

A unique designation denoting the type, mode of operation, the facilities included and the rated duration of the luminaire shall be clearly affixed to the luminaire.

The designation consists of a rectangle divided in three or four segments each containing one or more positions. Relevant to the construction a position shall obtain a letter or a figure, or a point if no indication has to be given.

The shape of the emergency lighting luminaire designation is as follows:

*	*	****	***
---	---	------	-----

The segments and positions have to be completed by letters and figures indicating the intended constructions.

- a) First segment containing one position:
TYPE
X self-contained
Z central supply
- b) Second segment containing one position:
MODE OF OPERATION
0 non-maintained
1 maintained
2 combined non-maintained
3 combined maintained
4 compound non-maintained

5 compound maintained

6 satellite

- c) Third segment containing four positions:
FACILITIES. To be completed where appropriate at the time of installation

A including test device

B including remote rest mode

C including inhibiting mode

D high-risk task-area luminaire

- d) Fourth segment containing three positions:
FOR SELF-CONTAINED LUMINAIRES. To indicate the minimum DURATION of the emergency mode expressed, in minutes;

10 to indicate 10 min duration

60 1 h duration

120 2 h duration

180 3 h duration

Two examples of a marking given to elucidate a selection:

X	1	*B *D	*60
---	---	----------	-----

Meaning: self-contained maintained luminaire including a remote rest mode and which is suitable for a high-risk task-area and having emergency mode duration of 60 min.

Z	1	****
---	---	------

Meaning: central supplied maintained luminaire.

ANNEX B

BATTERIES FOR EMERGENCY LUMINAIRES

(Clause 7.8)

B-1 Batteries incorporated in emergency lighting luminaires shall be one of the following types:

- a) Sealed nickel cadmium; and
- b) Valve regulated lead acid.

NOTE — Other battery types may be allowed provided they conform to their relevant safety and performance standard and the relevant requirements of this standard.

B-2 To comply with the requirements of 7.8, two aspects shall be met; firstly the battery shall conform to its relevant standard and secondly the luminaire shall operate within specific tolerances to ensure that the required performance can be maintained by the battery throughout its design life.

B-3 A battery's capacity shall be chosen so that the luminaire shall achieve its rated duration up to the time of battery replacement.

Compliance is checked by the following tests in **B-4** and **B-5**.

B-4 SEALED NICKEL CADMIUM BATTERIES

B-4.1 The battery shall conform to IS 14218 for cells intended for permanent charge at elevated temperatures.

B-4.2 The battery in the luminaire shall operate within the following limits:

- a) Maximum continuous ambient air temperature, measured by a thermocouple within 5 mm of but not touching the cells within the battery compartment of the luminaire, shall be 50°C;
- b) Maximum continuous overcharge rate shall be 0.08 C_5A (at 1.06 rated mains voltage);
- c) Minimum continuous ambient temperature of the cells within the luminaire shall be C (occasional outage to 0°C);
- d) Maximum discharge rates shall be for 1 h: 0.6 C_5A and for 3 h: 0.25 C_5A (excluding the initial starting period). The maximum discharge rates for other time periods may be interpolated from these values.

B-5 VALVE REGULATED LEAD ACID BATTERIES

B-5.1 The battery in the luminaire shall conform to the relevant requirements of IS 15549.

B-5.2 The battery in the luminaire shall operate within the following limits:

- a) Maximum continuous ambient air temperature, measured by a thermocouple within 5 mm of but not touching the cells within the battery compartment of the luminaire, shall be,
 - 1) 30°C with temperature compensation of float charge voltage normally between -3 mV/cell/°C and -4 mV/cell/°C or as recommended by the cell manufacturer, or
 - 2) 25°C without temperature compensation. The float charge voltage at 25°C shall be between 2.22 V/cell and 2.4 V/cell as recommended by the cell manufacturer;
- b) Maximum recharge current shall be 0.4 C_{20} ;
- c) Maximum discharge rates shall be for 1 h: 0.4 C_{20} and for 3 h: 0.17 C_{20} (excluding the initial starting period). The maximum discharge rates for other time periods may be interpolated from these values;
- d) Maximum rms ripple current shall be not more than 0.1 C_{20} ;
- e) Minimum continuous ambient temperature close to but not touching the cells within the luminaire shall be 5°C (occasional outages to 0°C).

B-6 The ambient air temperature of the cells within the luminaire shall be measured after 48 h from start of recharge.

B-7 If operating outside the limits given in **B-4** and **B-5**, alternative operating parameters and evidence of the four-year design life for the cells shall be supplied by the battery manufacturer.

ANNEX C

(Clause 17.5)

LUMINANCE MEASUREMENTS

C-1 CONTRAST

Illuminances are measured normal to the surface over a 10 mm diameter field for each coloured surface of the sign. The minimum and maximum luminance is measured over the areas, for each colour for the coloured background a 10 mm wide outer border is excluded from the measurements. In order to measure the luminance ratio between two adjacent colours, the luminance measurements shall be taken at a distance of 15 mm on either side of the junction of two colours, if the area of colour is less than 30 mm,

the 10 mm diameter measurement field shall be reduced. Typical example is given in Fig. 1

C-2 On site photometric tests: All illuminance measurements shall be made with a photopic V , corrected meter and all luminous measurements shall be made with a photopic, V , corrected meter.

The meter shall have an error tolerance of not greater than 10 percent.

At all times, the measured values shall be not less than those specified in this standard.

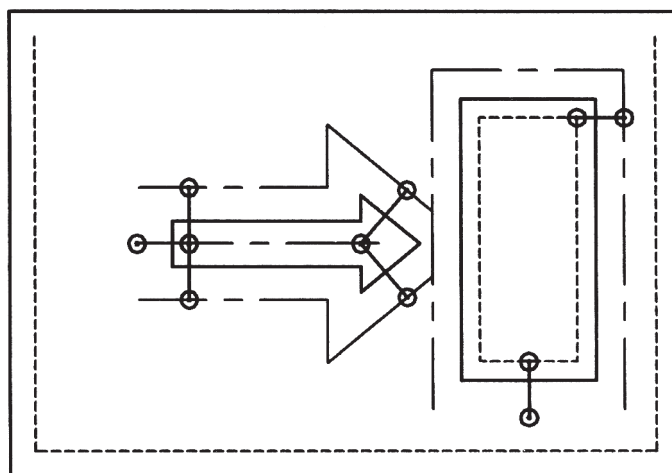


FIG. 1 TYPICAL EXAMPLE OF MEASUREMENT POSITIONS

ANNEX D

REST MODE AND INHIBITION MODE FACILITIES

(Clause 22)

D-1 Emergency luminaires need an unswitched supply so that when the power is switched off to the normal lighting luminaires, the emergency luminaires do not change over and the batteries remain connected to the supply and continue to be charged. In order to avoid unwanted discharges, rest mode or inhibiting mode facilities can be provided (see 22.4) to protect the integrity of batteries when the normal supply fails but emergency lighting is not needed at that time (or when the batteries are included with the luminaire and stored before installation). For both facilities, remote control devices must be installed via proper wiring.

The main characteristics of rest mode are:

- It can only be operated when the normal supply has failed, enabling battery capacity to be conserved, if not needed;
- The remote control wiring is fail-safe against short circuit, contact to earth or interruption;
- At the restoration of the normal supply, the luminaire reverts to normal mode.

NOTE — At the moment, remote control devices for rest mode operation are not standardized.

The main characteristics of inhibition mode are:

- a) It can be set independently from the condition of the normal power and therefore when the building is unoccupied, a supply failure or disconnection shall not cause an unwanted discharge;
- b) The protection against the interruption of the wiring to the remote control should be provided by a proper installation according to the relevant wiring rules of SP 30 concerning safety services that is,
 - 1) circuits of safety services should be independent of other circuits (*see* Note 1);
 - 2) circuits of safety services should not pass through locations exposed to fire risk unless they are fire-resistant. The circuits should not in any case pass through zones exposed to explosion risk;
 - 3) the protection against overload may be omitted;
 - 4) overcurrent protective devices should be used so as to avoid an overcurrent in one circuit impairing the correct operation of other circuits of safety services;
 - 5) switchgear and controlgear should be clearly identified and grouped in locations accessible only to competent persons;
 - 6) alarm devices should be clearly identified (*see* Note 2).

NOTES

1 This means that an electrical fault or any intervention or modification in one system shall not affect the correct functioning of any other circuits. This may necessitate separation by fire-resistant partitions, different routes or enclosures.

2 If service facilities are provided to inhibit output, they should comply with these requirements.

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